

Kaufman - Trading Systems & Methods - Chap10

Chap10

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10 Volume, Open Interest, and Breadth

Volume pattern has always been tied closely to chart analysis in both the stock and futures markets. It is a valuable piece of information that is not often used, and one of the few items, other than price, that is traditionally considered valid data for the technician. Nevertheless, there has been little research published that relates this factor to futures markets; its popular use has adopted the same conclusions as in stock market analysts.

The stock and futures markets have two other measures of participation that are related, yet not the same. In equities, the large number of shares being traded allow for measurements of breadth, in the same way that the stock index has become a popular measure of overall market trend, the breadth of the market is the total number of stocks that have risen or fallen during a specific period. When you have the ability to view the bigger picture of market movement, breadth seems to be the natural adjunct to the index.

In futures, open interest is the measurement of those participants with outstanding trades; it is the netting out of all open positions in any one market or contract, and it gives an understanding of the depth of volume that is possible. A market that trades only 10,000 contracts per day, but has an open interest of 250,000, is telling the trader that there are many participants who will enter the market when the price is right. These are most likely to be commercial traders, using the futures markets for hedging.

CONTRACT VOLUME VERSUS TOTAL VOLUME

In futures markets, in which individual contracts specify standard delivery months, the volume of each contract is available, along with the total volume of the market; that is, the total volume of all individual contracts. Spread transactions are not included in volume. This information is officially posted one day late, but estimates are available for many markets during the day. Total volume of crude oil is estimated even, hour and released to online news services.

Individual contract volume is important to determine the delivery month that is most active. Traders find that the best execution fills are most likely where there is greatest liquidity. Analysts, however, have a difficult time assessing volume trends because there is a natural increase in volume as a contract moves from second month out to the nearby and traders shift their positions to the closest delivery month; there is a corresponding decline in volume as the delivery date becomes close. Looking only at the volume of one delivery month is equivalent to ignoring seasonality in an agricultural market.

Each futures market has its unique pattern of volume for individual contracts. Some, such as the interest rates, shift abruptly on the last day of the month prior to delivery, because the exchange raises margins dramatically for all traders holding positions in the delivery month. Currencies are very different and tend to trade actively in the nearest month up to one or two days before that contract goes off the board. While volume

increases slightly in the next deferred contract, anyone trading sizable positions will need to stay with the nearby contract to the end.

Other than for determining which contract to trade, and perhaps the size order that the market can absorb, an analysis of volume as discussed in this chapter must use total volume, the aggregate of all contracts, to have a data series that does not suffer the patterns of increasing and decreasing participation based on the coming and going of individual delivery months. When traders roll from the nearby to the next deferred contract, the transactions are performed as a spread, and those trades are not included in the volume figures. Because positions are closed out in one contract and opened in another, there is no change in the open interest.

The stock market equivalent to using total volume would be to add the volume for all stocks in a similar group. This would help smooth over those periods when the volume of one stock is very low. If the group is not highly correlated in price movement, the end result might be a volume series that has very little to do with the stock you are trading.

Tick Volume

The popularity of quote machines and fast trading requires a measurement of volume that can be used immediately to make decisions. Because total volume is not available on a timely basis to day traders, tick volume has become a substitute. Tick volume is the number of changes in price, regardless of volume, that occur during any time interval. Tick volume relates directly to actual volume because, as markets become more active, prices change back and forth more often. If only two trades occur in a 5-minute period, then the market is not liquid, regardless of the size of the orders that changed hands. From an analytic view, tick volume gives a reasonable approximation of true volume and can be used as a substitute. From a practical view, it is the only choice. Tick volume patterns are discussed later in this chapter.

VARIATIONS FROM THE NORMAL PATTERNS

One final note of warning when using volume indicators to confirm price direction: markets have patterns in volume that cause the same effect as seasonality. To decide that a buy signal is more important because it came near the end of the trading day, when volume was much higher than midday, is not correct because volume is always higher at the beginning and end of the day. You may conclude, in general, that those two periods produce more reliable trading signals; however, a volume confirmation must be compared against the normal volume for that time period.

Open interest and market breadth also have seasonal patterns. In agricultural markets, farmers hedge in larger numbers during the growing season than in the winter, raising the open interest. In stocks, there is a lot of activity associated with the end-of-year positioning for tax purposes, and traditional rallying during holiday seasons. While this predictable market activity may be enough to confirm your positions, it does not indicate that something special is occurring. Identifying these variations will be discussed in detail later in this chapter.

Volume Drops and Spikes

Volume spikes are carefully watched because they are seen as a

significant positive action by the traders. For a stock that has been relatively inactive, a volume spike is a warning that something is changing. In futures, a day of very high activity means that the market is sensitive to news. In both cases, a sharp increase in volume can be a predictor of change, or at least of higher volatility. This will be discussed in the section "Volume as a Predictor of Volatility," later in this chapter.

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At this time it is worth remembering that a volume spike is a clear indicator of a positive action, while a volume drop can be ambiguous. Volume can decline because there is little interest in a stock or futures market; buying and selling pressure have been eliminated. When a currency, gold, or any traded product reaches a price that is considered fair (also called equilibrium), volume normally declines. Volume may also drop on the day before a holiday, or just by chance. While there are seasonal and other predictable patterns associated with volume drops, they are far less certain than large increases.

STANDARD INTERPRETATION

The interpretation of volume has been a part of market lore since charting began. The best consolidation of that information was published in the monograph by W.D. Jiler, *Volume and Open Interest: A Key to Commodity Price Forecasting*, a companion piece to his most popular *Forecasting Commodity Prices with Vertical Line Charts* (see references in Chapter 9 ("Charting")).

In both the futures and stock markets, volume has much the same interpretation, when volume increases it is said to confirm the direction of prices. Price changes that occur on very light volume are less dependable for indicating future direction than those changes associated with relatively heavy volume. An additional uncertainty exists for stocks that are not actively traded, and for low price shares where the total dollar volume can be small. In these cases it might be best to look at the accumulated volume of similar companies, or its sector.

Open interest is a concept unique to futures markets, but helps to explain the depth of the market as well as trader expectation. New interest in a market brings new buyers or sellers, which increases the open interest, the net of all outstanding contracts being traded. When the open interest increases while prices rise quickly, it is commonly interpreted as more traders entering long positions. This may seem strange because for every new buyer of a futures contract there must be a new seller; however, the seller is likely to be someone looking to hold a position for a few hours or days, looking to profit from the normal ups and downs of price movement. The position trader, who is willing to sit for much more time holding a long position, is the one who is attributed with the open interest. In reality, no one knows. However, if prices keep rising, the shorts are more likely to be forced out while the longs have staying power.

The traditional interpretation of changes in volume and open interest (for futures markets) can be summarized as follows:

Volume

Open Interest

Rising

Rising

Falling

Falling

Rising

Falling

Rising

Falling

Co

Pos

Slow

Co

Some of the generally accepted notions for the use of volume and open interest are:

1. Open interest increases during a trending period.
2. Volume may decline but open interest builds during an accumulation phase. Volume occasionally spikes.
3. Rising prices and declining volume/open interest indicate a pending change of direction.

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In the stock market, when confirming the direction of the overall market, the breadth of trading (percentage of rising to total stocks) should be used if it closely approximates the stocks in the index. It would be inconsistent, for example, to use the total breadth of all stocks traded on the New York Stock Exchange, to confirm a move in a portfolio that contained only the 30 stocks of the Dow Industrials. In that case, you would need to construct an indicator of breadth that used only those 30 stocks.

Exceptions

No method is without exceptions, including volume patterns in the stock market. There are days or periods when volume is expected to change, and must be considered in the analysis. For example, volume is lighter:

On the first day of the week

On the day before a holiday

During the summer

It is equally difficult to forget that volume is heavier on triple witching day, when S&P 500 futures, options on futures, and options on the cash index all expire at the same time.

In the futures markets, there are similar patterns. Lighter volume will exist during holiday periods and summer months, but may be heavier on Fridays and Mondays during a trending market or a weather market for agricultural products. Liquidation often occurs before the weekend, and positions are reentered on the first day of the week.

Richard Arms's Equivolume

Most of the techniques for using volume discussed in this chapter will multiply or accumulate volume, creating an index that rises faster as volume increases. Equivolume, a charting method introduced by Richard Arms, takes the unique approach of substituting volume for time along the bottom scale of a chart. When volume increases, the price bar is elongated

to the right, rather than the standard approach of extending the height of the bar.

There are no systematic methods for using this technique included here, and applications parallel standard chart interpretations; however, analysts can represent this type of chart by creating a new price series in which the daily closing price is repeated based on the relative volume. For example, if the normal volume day causes a closing price to be repeated 10 times, then a day with twice the volume will repeat that price 20 times, and a day with half the volume will show 5 prices. This approach may cause a shortterm moving average trend to look strange; however, a linear regression or longterm trend should reflect the importance of varying time.

VOLUME INDICATORS

Both the stock and futures markets are familiar to indicators that use only volume, or those that add volume, intending to make other calculations more robust. The following section gives the most popular of these indicators, most of which originate in the stock market and many of which use the number of advancing and declining stocks. Readers should note the way in which the data is used from one technique to another and consider the significance of these changes. They will be discussed at the end of this section.

Volume Momentum and Percentage Change

The most basic of volume indicators are momentum and rate of change. These techniques treat volume as price. For momentum, this means finding the change in volume over a spe

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cific time interval; percentage change measures the size of the volume change relative to the starting value.

$$\text{Volume Momentum} = \text{volume today} - \text{volume } n\text{-days ago}$$

$$\text{Volume \%} = \frac{\text{volume today} - \text{volume } n\text{-days ago}}{\text{volume } n\text{-days ago}}$$

OnBalance Volume

Made famous by Joseph Granville, OnBalance Volume (OBV)' is now a byword in stock analyst circles. On days when prices close higher, it is assumed that all volume is representative of the buyers; on lower days, the volume is controlled by the sellers. Although each day yields a new value, these values are added together to form a new series. The result is a volumeweighted series. In the following formula, the expression in parentheses simply uses the closing prices to produce a value of +1, 0, or 1, which then determines whether today's volume will be added or subtracted from the volume series:

$$OBV_{\text{today}} = OBV_{\text{previous}} + \left(\frac{\text{close} - \text{close}_{\text{previous}}}{@abs(\text{close} - \text{close}_{\text{previous}})} \right)$$

Determining the OBV manually is a simple accumulation process. In Table 101, there was greater volume on days in which prices rose and lower volume on declining days. This is expected in a market with a clear uptrend. The advantage of recording the OBV is in observing when the trend of the prices diverges from the OBV values. The general interpretation of OBV is given in Table 102.

Because a volume series has many erratic qualities, caused by large variations in volume from day to day, it is most often used by applying a trend from 1 to 100 weeks, then identifying a simple volume direction when the OBV value crosses the trend. An upward trend in volume is interpreted as a confirmation of the current price direction, while a downturn in volume can be liquidation or uncertainty

Simple Variation

An indicator that closely resembles OnBalance Volume is a running total of the days when volume increases minus the days when volume declines. That is, add 1 to the cumulative value on a day when today's volume is greater than the previous day, otherwise subtract 1. This volume count indicator (VCI) can be written as:

Robert W Colby and Thomas A. Meyers, The Encyclopedia of Technical Market indicators (Dow Jones-Irwin, 1988) is a comprehensive study of most market indicators, including OnBalance Volume and some other techniques included in this section.

TABLE 10 1 Calculating OnBalance Volume

Closing Price	Daily Volume (in 1,000s)	On-Bal Volume
310	25	25
315	30	55
318	27	82
316	15	67
314	12	55
320	28	83

TABLE 102 Interpreting OnBalance Volume

<i>Price Direction</i>	<i>OBV Direction</i>	<i>Interpretation</i>
Up	Up	Clear uptrend
	Sideways	Moderate uptrend
	Down	Weak uptrend near reversal
Sideways	Up	Accumulation period (bottom)
	Sideways	No determination
	Down	Distribution period (top)
Down	Up	Weak downtrend near reversal
	Sideways	Moderate downtrend
	Down	Clear downtrend

$$VCI_{\text{today}} = VCI_{\text{previous}} + \frac{\text{volume}_{\text{today}} - \text{volume}_{\text{previous}}}{@abs(\text{volume}_{\text{today}} - \text{volume}_{\text{previous}})}$$

Volume Accumulator

A modification to Granville's OBV system is Mark Chaiken's Volume Accumulator (VA). Instead of assigning all the volume to either the buyers or the sellers, the Volume Accumulator uses a proportional amount of volume corresponding to the relationship of the closing price to the intraday mean price. If prices close at the high or low of the day, all volume is given to the buyers or sellers as in the OBV calculation.' If the close is at the midrange, no volume is added.

$$VA_{\text{today}} = VA_{\text{previous}} + \left(\frac{\text{close} - \text{low}}{\text{high} - \text{low}} \right)$$

Other Accumulation Index Techniques

The Price and Volume Trend (PVT) applies volume to the percentage price change from close to close, which can be positive or negative. The Positive Volume Index (PVI) and Negative Volume Index (NVI) take the approach that a single indicator, which adds and subtracts volume based on market direction, is not as informative as two separate series that can be viewed at the same time.

$$PVT_{\text{today}} = PVT_{\text{previous}} + \left(\frac{\text{close} - \text{close}_{\text{previous}}}{\text{close}_{\text{previous}}} \right) \times \text{volume}$$

if $\text{close} < \text{close}_{\text{previous}}$ then $PVI_{\text{today}} = PVI_{\text{previous}} + \text{volume}$

if $\text{close} > \text{close}_{\text{previous}}$ then $NVI_{\text{today}} = NVI_{\text{previous}} + \text{volume}$

Separating Advancing from Declining Volume

The most basic of all techniques for determining market breadth is the AdvanceDecline Index, which creates a new series by adding the net of the number of advancing and declining stocks each day. Unchanged issues are ignored.

' Both OBV and the Volume Accumulator are characterized as momentum systems. See Chapter 6 for more information on similar techniques.

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AdvanceDecline Oscillator = Advances - Declines

AdvanceDecline Index, $\sim$ = AdvanceDecline Index, j ..., + advance - decline

In some of the techniques that follow, only the oscillator, or singleperiod calculation, may be shown. An index can be created by accumulating these values.

Sibbett's Demand Index

one method that smooths out volume because it uses the total activity of the past 10 days is James Sibbett's Demand Index. The technique bears a resemblance to the approach used in Wilder's RSI. It can be used as an oscillator with individual daily values or accumulated into an index. The individual days are calculated as:

$$\text{Demand Index} = \frac{\text{@sum}(\text{upside volume})}{\text{@sum}(\text{downside volume})}$$

where @sum is a function that sums the past 10 days of upside and downside volume, found in the Wall Street Journal under the heading "Trading Activity" Arthur Merrill, another wellknown stock analyst, has suggested applying 5 days to this same technique.

Asprays Demand Oscillator

Using direction to separate volume into two series of Buying Pressure and Selling Pressure, Aspray then nets them into his own Demand Oscillator. Note that during a rising market the selling pressure has been divided by a percentage of the volume, which has been scaled to be greater than 1. The following calculations show the separate steps needed to create Aspray's Demand Oscillator:

For rising prices:
 Buying Pressure = volume

$$\text{Selling Pressure} = \frac{\text{volume}}{\left(K \times \frac{\text{close}_{\text{today}} - \text{close}_{\text{previous}}}{\text{close}_{\text{previous}}} \right)}$$

For declining prices:

$$\text{Buying Pressure} = \frac{\text{volume}}{\left(K \times \frac{\text{close}_{\text{today}} - \text{close}_{\text{previous}}}{\text{close}_{\text{previous}}} \right)}$$

and where

$$K = \frac{3 \times \text{close}}{\text{@avg}(\text{@highest}(\text{high}, 2) - \text{@lowest}(\text{low}, 2), 10)}$$

and

Demand Oscillator = BP - SP

K is a volatility scaling factor, which is 3 times the closing price divided by the 10day moving average of the 2day highlow range, and has a value likely to be well over 100. For example, if the S&P is trading at 600 and the average volatility is 10 full basis points (which is very high for a 10day average), then $K = 1,800/10 = 180$.

3 Thomas Aspray, "Finetuning the Demand Index," *Technical Analysis of Stocks & Commodities* (June 1986), and "Demand Oscillator Momentum," *Technical Analysis of Stocks & Commodities* (September 1989).

BoltonTremblay

Introducing the net advancing stocks compared with the number of stocks that were unchanged, the BoltonTremblay approach also includes a form of geometric weighting of the results:

$$\text{Bolton-Tremblay}_{\text{today}} = \frac{\text{advancing} - \text{declining}}{\text{unchanged}}$$

if $\text{Bolton-Tremblay}_{\text{today}} > 0$ then $\text{Accum BT}_{\text{today}} = \text{Accum BT}_{\text{pr}}$

if $\text{Bolton-Tremblay}_{\text{today}} < 0$ then $\text{Accum BT}_{\text{today}} = \text{Accum BT}_{\text{pr}}$

Schultz

Schultz chose to look at the advancing stocks only as a percent

$$\text{Schultz A/T}_{\text{today}} = \text{Schultz A/T}_{\text{previous}} + \frac{\text{advancing}}{\text{advancing} + \text{declining}}$$

McClellan Oscillator

Similar to the AdvanceDecline Index, the McClellan Oscillator does not accumulate the net change in breadth, but looks at the individual changes as an oscillator:

McClellan Oscillator = advances - declines

Upside/Downside Ratio

A simple upside/downside ratio (UDR) has also been used; however, the ratio value has no symmetry. When the declining volume is very low, for example, only 20% of the total volume, the UDR will have a value of 4.0. In contrast, if the advancing volume is low, the ratio is limited to the range between 0 and 1.

$$\text{UDR} = \frac{\text{Advancing volume}}{\text{Declining volume}}$$

Tick Volume Indicator

in a manner similar to Wilder's RSI, Blau double smooths the tick volume as a way of confirming price direction. The Tick Volume Indicator (seen in Figure 101) is:

$$\text{TVI}(r, s) = \frac{100 \times \text{DEMA}(\text{upticks}, r, s) - \text{DEMA}(\text{downticks}, r, s)}{\text{DEMA}(\text{upticks}, r, s) + \text{DEMA}(\text{downticks}, r, s)}$$

which ranges from 100 to +100 and where DEMA is the double (EMA) smoothing of the downticks or upticks over the past s bars, with the initial smoothing over r bars.

Programming Volume Indicators

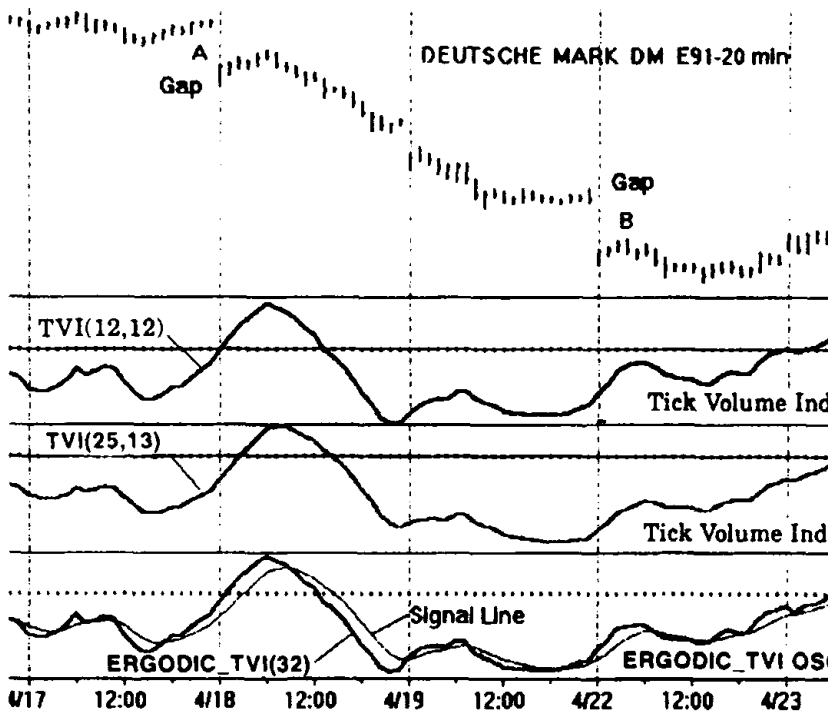
Volume indicators are easy programming on both a spreadsheet and Omega's Easy Language. The following examples include only some of the indicators discussed in this chapter; the others are very similar and

can be added using the same form.
Spreadsheet Code

Using Corel's Quattro, the following spreadsheet shows the Eurodollars beginning in April 1993. The calculations for OnBalance Volume, Volume Accumulator, and PriceVolume

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FIGURE 101 Blaus Tick Volume Indicator.



Source: William Blau, *Momentum, Direction, and Divergence* (John Wiley & Sons, 1995).
Blau. Reprinted by permission of John Wiley & Sons, Inc.

Trend are shown in the rightmost three columns. The spreadsheet code for these calculations are shown after the sample output.

Col	Name	Start Row	
A	Date	5	
B	High	5	
C	Low	5	
D	Close	5	
E	Volume	5	
F	OBV	7	@IF(D7-D6>0,F6+F7,@IF(D7-D6<0,F6
G	VACC	7	+G6+(((D7-C7)/(B7-C7))-0.5)*2*E7
H	PVT	7	+H6+E7*(D7-D6)/D6
I	MAP	45	@AVG(D26.D45)
J	PX	48	(I48-I46)*100/I45
K	MA	45	@AVG(D6.D45)
L	MADIFF	48	+K48-K45
M	MAV	45	@AVG(F26.F45) [for OBV]
N	VX	48	(M48-M45)*100/M45
O	DVG	48	@IF(J48*N48<0,J48-N48,0)
P	OBV VX	Signal from row 49	@IF(L49>0#AND#L48<=0#AND#N49>=0 @IF(L49>0#AND#L48<=0,"exit", @IF(L49<=0#AND#L48>0#AND#N49>=0 @IF(L49<=0#AND#L48>0,"exit", @IF(L49<\$D\$3,"exitALL",""))))
Q	OBV VX DVG	Signal from row 49	

			@ IF(L49>0#AND#L48<=0#AND#N49>=\$
			#AND#@ ABS(O49)<=\$E\$3,"buy
			@ IF(L49>0#AND#L48<=0,"exitS
			@ IF(L49<=0#AND#L48>0,#AND
			#AND#@ ABS(O49)<=\$E\$3,"sell
			@ IF(L49<=0#AND#L48>0,"exitL
			@ IF(L49<\$D\$3#AND#@ ABS(O
			"exitALL","")))))
R	Mom Osc	25	(@AVG(E22.E25) - @AVG(E25.E6))*100
S	Avg Mom	45	@AVG(R26.R45)
T	StDev Mom	45	@STD(R26.R45)
U	Mom Signal	45	@ IF(L45>0#AND#L44<=0#AND#R45>=S
			@ IF(L45>0#AND#L44<=0,"exitS
			@ IF(L45<=0#AND#L44>0#AND
			@ IF(L45<=0#AND#L44>0,"exitL
V	ROC	25	(E25-E6)*100/E6
W	Avg ROC	45	@AVG(V26-V45)
X	StDev ROC	45	@STD(V26.V45)
Y	ROC Signal	45	@ IF(L45>0#AND#L44<=0#AND#V45>=V
			@ IF(L45>0#AND#L44<=0,"exitS
			@ IF(L45<=0#AND#L44>0#AND
			W45-\$F\$3*T45,"sell",@ IF(L45<=

Omega's Easy Language Code

The following program code gives an example of a system that uses one of eight volume measurements to filter the entry or exit of a trade. When the input t t y p e is negative the input values are treated as an entry filter; when t t y p e is positive the values are used for an exit filter.

```

{PJK Volume: Create a volume filter
  Copyright 1995-1998, PJKaufman. All rights reserved.

inputs: period(20), ttype(1), maxdn(0), maxdvg(0),
vars:   px(0), vx(0), Kvol(0), map(0), mav(0),
       nd(0), madiff(0), avgv(0), sdv(0), tentry(0),
       avghl(0), signhl(0);
{Exit type
    =1, On-Balance Volume
    =2, Chiaken Volume Accumulation
    =3, Negative Volume Index
    =4, Positive Volume Index
    =5, Price and Volume Trend
    =6, Volume oscillator (npsd)
    =7, Volume rate of change
    =8, Low volume exit

For entry filter use negative type

{test exit}
type = ttype;
if type < 0 then begin
    tentry = 1;
    type = @absvalue(ttype);
end;

{price index}
map = @average(close,period);

if ddays < 1 then nd = 1 else nd = ddays;
if map[nd] = 0 then px = 0 else px = (map - map[nd]);

{On-Balance Volume}
if type = 1 then begin

```



```

    if close > close[1] then KMAvol = KMAvol + volume
        else if close < close[1] then Kvol = Kvol - volume;
end;

{Chaikin Volume Accumulator }
if type = 2 then Kvol = Kvol +(((close - low) / (high - low)) - .5)*2*volume

{Negative Volume Index}
if type = 3 then begin
    if volume < volume[1] then Kvol = Kvol[1] + (close - close[1])*Kvol/close[1]
        else if Kvol = 0 then Kvol = volume
            else Kvol = Kvol[1];
end;

{Positive Volume Index}
if type = 4 then begin
    if volume > volume[1] then Kvol = Kvol[1] + (close - close[1])*Kvol[1]/close[1]
        else if Kvol = 0 then Kvol = volume
            else Kvol = Kvol[1];
end;

{Price and Volume Trend}
if type = 5 then Kvol = Kvol +volume*(close - close[1]) / close[1]

{Volume oscillator}
if type = 6 then
    Kvol = (@average(volume,ddays) -
        @average(volume,period))*100/@average(volume,ddays);

{Volume rate-of-change}
if type = 7 then begin
    if Kvol = 0 then Kvol = volume;
    if volume[period] = 0 then Kvol = Kvol[1] else
        Kvol = (volume - volume[period])*100/volume[period];
end;

{Moving average of price}
madays = 2*period;
ma = @average(close,madays);
madiff = ma - ma[nd];

if type < 6 or type = 9 then begin
    mav = @average(Kvol,period);
    if mav[nd] = 0 then vx = 0 else vx = (mav - mav[nd])*100/mav[nd];
    sdiff = px - vx;
{record divergence only}
    if vx*px < 0 then dvg = sdiff else dvg = 0;
    if madiff > 0 and madiff[1] <= 0 then begin
        exitshort at market;
        if tentry = 0 and (vx >= maxdn and @absvalue(dvg) <= maxdvg) then
            buy at market;
        end;
    if madiff < 0 and madiff[1] >= 0 then begin
        exitlong at market;
        if tentry = 0 and (vx >= maxdn and @absvalue(dvg) <= maxdvg) then
            sell at market;
        end;
    if vx < maxdn and @absvalue(dvg) > maxdvg then begin
        exitlong at market;
        exitshort at market;
        end;
end;
end;

```

```

if type = 6 or type = 7 then begin
    avgv = @average(Kvol,period);
    sdv = @stddev(Kvol,period);
    if tentry = 0 then begin
        if (madiff > 0 and madiff[1] <= 0) or Kvol <= avgv-npsd
            exitshort at market;
        if (madiff < 0 and madiff[1] >= 0) or Kvol <= avgv-npsd
            exitlong at market;
        if madiff > 0 and madiff[1] <= 0 then buy at market;
        if madiff < 0 and madiff[1] >= 0 then sell at market;
        end
    else begin
        if madiff > 0 and madiff[1] <= 0 then exitshort at market;
        if madiff < 0 and madiff[1] >= 0 then exitlong at market;
        if madiff > 0 and madiff[1] <= 0 and Kvol <= avgv-npsd
            buy at market;
        if madiff < 0 and madiff[1] >= 0 and Kvol <= avgv-npsd
            sell at market;
        end;
    end;
end;

!Low volume exit, comparing slow and fast average!
if type = 8 then begin
    avgv = @average(volume,period);
    avg2 = @average(volume,ddays);

    if tentry = 0 then begin
        if (madiff > 0 and madiff[1] <= 0) or avg2 <= avgv*npstd
            then exitshort at market;
        if (madiff < 0 and madiff[1] >= 0) or avg2 <= avgv*npstd
            then exitlong at market;
        if madiff > 0 and madiff[1] <= 0 then buy at market;
        if madiff < 0 and madiff[1] >= 0 then sell at market;
        end
    else begin
        if madiff > 0 and madiff[1] <= 0 then exitshort at market;
        if madiff < 0 and madiff[1] >= 0 then exitlong at market;
        if madiff > 0 and madiff[1] <= 0 and avg2 <= avgv*npstd
            then buy at market;
        if madiff < 0 and madiff[1] >= 0 and avg2 <= avgv*npstd
            then sell at market;
        end;
    end;
end;

```

Is OneVolume/Breadth Indicator Better Than Another?

The final test of a successful indicator is whether it adds value to

your trading decisions. This can be determined by programming the indicator into the total strategy and testing the rules over a reasonable historic time period. Before doing that, we should decide what the increase or decrease in volume or breadth is telling us. If performance testing does not confirm our expectations, then we must rethink the approach because the chance of an error has increased. What appears to be a profitable discovery may only be an unlikely coincidence.

Looking at the selection of indicators, we see that small net changes in price can result in all volume being designated to one market direction. This is the case with Granville's OnBalance Volume and BoltonTremblay. Is it reasonable to add all volume to the accumulated index if the S&P gained only a fraction of one point? On a single day this may seem to be arbitrary, but just as so many of the simple systems, over a long period of time the net effect of this approach is sound. In addition, we should not forget that these indicators fail to account for a range of noise that is similar to the erratic movement of prices: that is,

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there is a normal variation in volume that does not mean anything special. On the other side, these indicators fail to isolate outliers, the significant events or price shocks that are associated with high volatility

The changes made by Mark Chaiken, which take a percentage of volume based on the relative close of prices within the daily range, have a very sensible basis and avoid the all-or-nothing technique used in OnBalance Volume. Sibbett's Demand Index, by using the sum of 10 days' volume, avoids this problem completely and smooths out results, a situation often needed when using the highly variable values of volume and breadth.

On the more confusing side, it has been suggested that the Demand Index, which simply accumulates the net of advances minus declines, be used with the absolute value of the daily calculation, Advances Declines. That would give the same value when advances outnumber declines by the same amount as declines outnumbering advances, which appears to lose information and fails to distinguish between market direction. Unless you clearly understand why taking the absolute value of any advanced decline formula makes sense, they should be avoided, even if historical testing shows a better result than other methods.

By seeing these indicators close together, they appear to be a collection of minor manipulations of data. The resulting series still requires interpretation using trendlines, divergence, or new highs and lows. Instead of having to interpret only the difficult movements of prices, we have added an equally difficult series of volume. While it is not clear that volume is always useful in analyzing price movement, it can impart valuable information in certain situations.

INTERPRETING VOLUME SYSTEMATICALLY

Most systematic approaches to volume apply a long-term smoothing method to the data, then identify trend changes to confirm price direction. This can be implemented with any of the accumulation indices, but not with single-day momentum or oscillator values. For the oscillators, most analysts have taken the approach that high volume confirms a new price

direction; therefore, they look for a reversal signal at the same time as peak or nearpeak volume. If they do not occur at the same time, a volume peak should precede a trend change. A decline in volume has also been used to confirm direction, but it is more likely to indicate that prices have reached equilibrium, and that a further advance or decline requires additional confirmation.

Moving Average Approaches

A straightforward way of using volume is to calculate a 10day moving average of the volume to be used as a confirmation of a 20day trend position.' By simply requiring the current volume to be greater than the average volume over that past 10 days, you introduce the idea of greater participation associated with the new trend. An additional important benefit is that this volume condition acts as a filter, eliminating a substantial number of trades. if the net returns are the same, the volumefiltered approach is far better because you are out of the market more, and are not reversing your position every time there is a new signal.

A similar method was proposed by Waxenberg.' A 10day moving average of the volume is calculated as the normal level, and a change in trend must be confirmed by a 20%

'Alex Saitta, 'A Price and VolumeBased System," Technical Analysis of Stocks & Commodities (March 1996).

'Howard K. Waxenberg, "Technical Analysis of Volume," Technical Analysis of Stocks & Commodities (March 1986).

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increase in volume above this norm. (The 20% band acts as an additional smoothing filter, but may be replaced by a longer trend and smaller band.) Extremes in a trending move can be found at points that exceed approximately a 40% volume increase. Applied to the stock market, Waxenberg used the extreme volumes to indicate the end of a selloff. To add more flexibility for longer test periods, and to adjust for volatility, Bollinger bands (based on about 2 standard deviations, or 95% probability) can be substituted for the fixed percentage bands.

Alternately, using 13 days of volume, subtract the total down volume from the total up volume. A plot of the results will serve as a momentum indicator from which overbought and oversold levels can be identified. if these values are unstable due to lack of liquidity, they may be smoothed using a shortterm moving average.

AdvanceDecline System

Advance and decline values, as with most volume figures, can be more useful if they are smoothed. By combining peak values of the net of smoothed advancing and declining shares with a directional move in price, Connors and Hayward have created a basic system structure that they named CHADTp6 (ConnorsHayward AdvanceDecline Trading Patterns). This system tries to identify reversal patterns by applying the following steps:

1. Add the past 5 days of advancing issues (New York Stock Exchange)
2. Add the past 5 days of declining issues (New York Stock Exchange)
3. Subtract the 5day sum of declining issues (1) from the advancing issues

(2)

4. Divide by 5 to get the average daily value

$CHADTP = (\text{@sum(advNYSE,5)} - \text{@sum(dec 1 NYSE,5)}) / 5$

To trade using this oscillator, Connors and Hayward have determined that ± 400 are the extreme levels where the values have been overbought and oversold. Based on this, we can apply the following rules to the S&P futures:

1. Sell when $CHADTP > +400$ and the SP trades .10 below the low of the previous day; buy when $CHADTP < -400$ and the SP trades .10 above the high of the previous day.
2. Note that the oscillator does not have to exceed its recent extremes on the day of the buy or sell signal.
3. Timing is best if the signal corresponds to a newspaper commentary indicating "depressed volume" (which is seen as an excess of cash waiting to enter).

This system targets returns over a 5 to 7 day period. A drop in the oscillator, which results in values in the midrange, is an opportunity to exit, or a standard oscillator of price can be constructed to generate overbought and oversold signals within this time frame. An opposite entry signal would reverse the position.

AN INTEGRATED PROBABILITY MODEL

If there is a noticeable relationship between price, volume, and open interest (or market breadth), then a probability model can be constructed to test its importance.' To do this it is necessary to construct a onedayahead forecast using a simple linear regression model, then backtest weighting factors for each element. Because of the powerful software products, this has become a very manageable process. Using Omega's EasyLanguage, each onedayahead forecast is determined using n past days:

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1. **Price forecast:** $Pf = \text{Price} + \text{LinearRegSlope}(\text{close}, n)$
2. **Volume forecast:** $Vf = \text{Volume} + \text{LinearRegSlope}(\text{volume}, n)$
3. **Open interest forecast:** $Of = \text{Opint} + \text{LinearRegSlope}(\text{open interest}, n)$
4. **On-Balance Volume forecast:** $OBVf = \text{OBV} + \text{LinearRegSlope}(\text{OBV}, n)$

The function *LinearRegSlope* gives the one-period intercept on a straight-line fit of the past n days, and can be used for a one-day-ahead forecast. The period n can be selected by a value from the forecast and creating an error series to measure the deviation. The number of days, n , that generates the slope for the forecast period. It is likely that the optimal forecast period for the items above, and this becomes a matter of concern. Should the period be the same for all of the predictions? If we are not sure, then fixing the periods at the same length does not help. To discover whether a change in volume is related to a change in the same regression interval seems important. (This topic is thoroughly discussed in Chapter 21 (“Testing”).

Having found the four one-day-ahead forecasts, a weighted average weight w_1 to the price forecast and the balance, $1 - w_1$, to the volume factors. This assumes that price is the most important factor.

$$\text{Forecast Index} = w_1 \times \text{Pf} + (1 - w_1) \times \text{Vf}$$

This formula can be backtested for values of w_1 , w_2 , and w_3 . The index can be used instead of price for determining trends, or average, or some trendline, to signal new uptrends. If successful, should be more reliable than only using price.

One advantage of testing the weighting factors is that, if helpful in predicting a trend, the weighting factor does not cluster the nonprice data together, would

$$\text{Forecast Index} = w_1\text{Pf} + w_2\text{Vf} + w_3\text{Of} + w_4\text{OBVf}$$

and where
$$\sum_{i=1}^4 w_i = 1$$

The sum of the weighting factors should always be 1, equal to 100%.

INTRADAY VOLUME PATTERNS

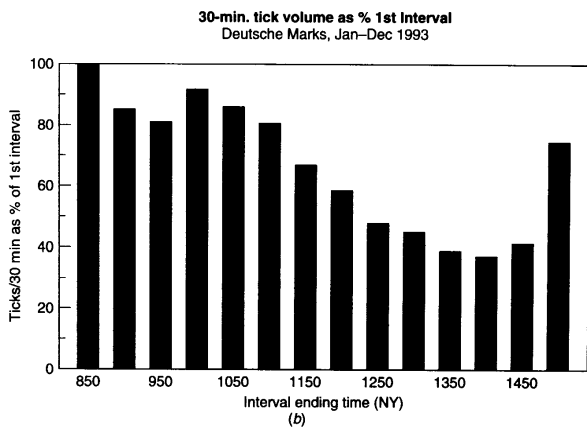
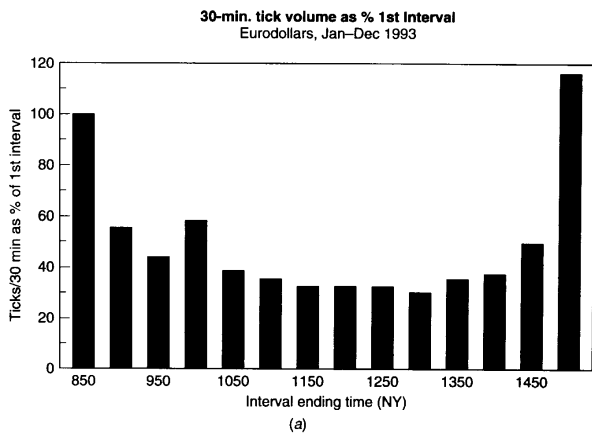
Identifying increases and decreases in volume during the trading day must consider overriding patterns caused by the way traders enter orders. The pattern of intraday volume can be seen using tick volume as a practical substitute for actual volume, which is usually not available until the next day. To create a meaningful chart of 30minute volume patterns, each interval was compared with the first 30 minutes of the day and recorded as a percentage of that initial tick volume. Figure 102 shows the results of three futures markets, Eurodollars, S&P 500, and Deutschemarks taken over a 1year period using the nearest delivery.

The patterns of the three markets shown in Figure 102 are similar in that the greatest volume is at the beginning and end of the trading day, yet very different in their internal patterns. Eurodollars, which have the highest volume of all futures markets, show much larger volume on the opening and closing 30minute periods.

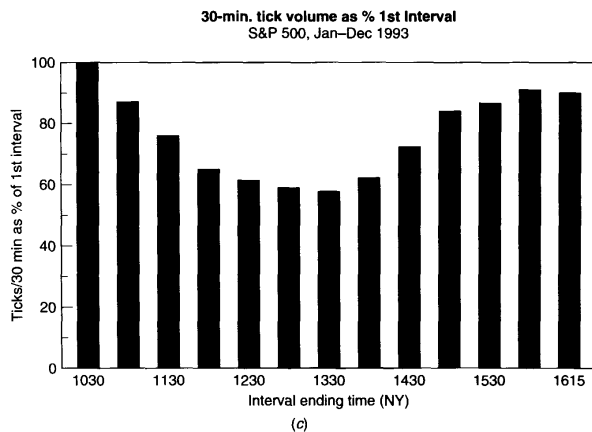
It should not be surprising to see the extreme clustering at both ends of the trading day. Orders enter the market early in reaction to news and events that occurred since the close of the previous day's trading. There are also orders resulting from trading decisions based on the previous day's data but calculated after the close. The end of day is active

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FIGURE 102 Patterns of 30minute tick volume, 1993. (a) Eurodollars. (b) S&P 500.
(c) Deutschemarks.



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FIGURE 102 (Continued)



because of juggling for position based on today's price movements. For

most traders, the closing price is the most dependable value of the day.

There is a typical rounded bottom formation on most charts, with lowest volume in the late morning when traders take their breaks. Deutsche marks (Figure 102c) differ from the others by showing more sustained high volume through late morning. This is because the European markets are open during that period. London interbank markets are likely to be open at 5 P.m. (12 noon in New York), to overlap U.S. trading as much as possible. Volume on the IMM Deutschemark contract tapers off after European business hours end.

When trading based on an increase in volume, these patterns must serve as the norm. To decide whether there is a volume confirmation for a trade to be entered at 11 A.M., YOU must compare today's 30minute volume for the 11 A.M. interval with the previous average volume for this same period only. This is equivalent to deseasonalizing or detrending the data. Even with this precaution, an increase in volume for a thinly traded market, such as cocoa, may appear significant because the 30minute volume jumped from 100 contracts to 300 contracts during midday. This can easily be misleading. You will need to consider the sample error in lowvolume markets or demand much larger volume changes to be more certain.

FILTERING LOW VOLUME

It seems clear that minutes, hours, or even days that have little market activity are likely to be associated with uncertain price direction. If the British pound moves the equivalent of \$.50 in the early afternoon of the U.S. market, we know that volume is normally light and the London and European markets are closed. If the intention of a volume indicator is to identify positive moves in volume that can be used as a confirmation of price direction, then eliminating those days with low volume, or with marginal price moves, may make the volume indicator dependable.

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Removing LowVolume Periods

The inclusion of lowvolume periods into a volume index may make the index movements unreliable. There is a similar situation in statistics, where a number of statistical values are slightly skewed to one side. Each value on its own is not noticeably important, but collectively they cause a bias. Some analysts believe that the collective weight creates a significant situation, while others favor ignoring any statistic that is too close to the norm to be distinguished. When you ignore the individual values, there is no collective value. In the same way, by ignoring days with low volume, you do not have to risk the chance of posting a series of days, all of which may be uncertain, that result in a confirmation of a new price direction. Days may be filtered if the volume falls one standard deviation below the average (removing 16% of the total days), or two standard deviations (removing only 2.5% of the days), or any other combination. The use of absolute volume numbers, such as a day on the New York Stock Exchange with volume under 200 million, will not allow consistent filtering over any prolonged test. Then, on any day, the VolumeFiltered OnBalance Volume would be found by the following program or spreadsheet steps:

```

volume_threshold = @AVG(volume, n) + f*@STD(v
if volume < volume_threshold then VFOBv = VFO
else VFOBv = VFOBv[1] + ((close - close[1]

```

where n is the number of periods in the average
f is the number of standard deviations used

Removing Volume Associated with Small Price Moves

Indicators such as OnBalance Volume post all volume as either a positive or negative contribution to the index, based on the direction of prices on that day. It is fair to question the validity of posting all volume to the upside when the S&P 500 closed up a minimum move of onetwentieth of one point (+.05). It could just as easily have closed down that amount. In a manner similar to filtering lowvolume periods, in the section above, periods in which prices moved very little may be eliminated by using a standard deviation of the price changes as a filter. Days which are within $\pm .5$ or ± 1.0 standard deviations of the average would be ignored. The PriceFiltered OnBalance Volume would then be found as follows:

```

price_threshold = @AVG(price - price[1], n
if @ABS(price - price[1]) < price_threshol
else PFOBv = PFOBv[1] + ((close - clos

```

where n is the number of periods in the average and standard deviation
f is the number of standard deviations used to filter minimum
volume

Note that, in the case of a minimum price threshold, the rules look at price change, which can be positive or negative. For a volume threshold there is only a onesided test.

MARKET FACILITATION INDEX

In weighing the likelihood that prices are indicating a direction, rather than a false start, the tick volume compared with the price range for the same period, called the Market Facilitation Index,' can measure the willingness of the market to move the price. This concept is interesting because it is not clear that high volume results in a large price move, although it appears to set up the conditions for high volatility if the Market Facilitation Index increases, then the market is willing to move the price; therefore, trading profits are more likely.

'Bill Willianis, Trading Chaos (John Wiley & Sons, 1995).

$$\text{Market Facilitation Index} = \frac{\text{range}}{\text{volume}} = \frac{\text{high} - \text{low}}{\text{volume}}$$

The results of combining the change in tick volume and the Market Facilitation Index are interpreted as:

<i>Tick Volume</i>	<i>Market Facilitation Index</i>	<i>Interpretation</i>
Up	Up	Confirmation of trend
Down	Down	False direction, do not trade
Down	Up	Poor entry timing
Up	Down	Potential new trend

SOURCES OF INFORMATION

In addition to the various references in this chapter, the following is a list of sources containing useful information on volume:

Steven B. Achelis, *Technical Analysis from A to Z* (Probus, 1995)
 Colby and Meyers, *The Encyclopedia of Technical Market Indicators* (Dow Jones Irwin, 1988)
 CompuTrac Manual (Telerate, 1990)
 Edwards and Magee, *Technical Analysis of Stock Trends* (Edwards and Magee, 1948)
 Dr. Alexander Elder, *Trading for a Living* (John Wiley & Sons, 1994)
 Omega TradeStation, *Easy Language Manual* (Omega Research, 1995)
 Martin J. Pring, *Technical Analysis Explained* (McGrawHill, 1991)
 Kenneth H. Shaleen, *Volume and Open Interest* (Probus, 1991)